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A STUDY OF U.S. ARMS SALES AND THE
TRANSFER OF DEFENSE TECHNOLOGY
TO THE NAVY OF THE
REPUBLIC OF CHINA (TAIWAN)

by

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by

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iii



TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	REVIEW OF THE U.S. FMS	6
A.	GENERAL	6
B.	CHRONOLOGICAL SEQUENCE OF FMS IN THE UNITED STATES	7
III.	THE SECURITY OF THE REPUBLIC OF CHINA AND U.S. ARMS SALES	22
A.	GENERAL	22
B.	THE STRATEGIC VALUE OF THE REPUBLIC OF CHINA .	23
C.	COMMUNIST CHINA'S CURRENT STRATAGEM AGAINST THE ROC	26
D.	REINFORCE NAVAL STRENGTH, CORNERSTONE OF TAIWAN'S SECURITY	28
IV.	CULTIVATION OF NAVAL SHIP DESIGN	33
A.	GENERAL	33
B.	TAIWAN SHIPBUILDING INDUSTRY	34
C.	OUTLINE OF U.S. NAVAL SHIP ACQUISITION PROCESS	36
D.	DESIGN CAPABILITY, THE KEY FACTOR IN SHIP ACQUISITION PROCESS	47
V.	RECOMMENDATIONS AND CONCLUSIONS	54
A.	RECOMMENDATIONS	54
B.	CONCLUSIONS	54
	LIST OF REFERENCES	56
	BIBLIOGRAPHY	57
	INITIAL DISTRIBUTION LIST	58

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I. INTRODUCTION

The United States, a well-developed democratic country with vast territory and rich resources, has been the largest supplier of conventional arms in the 20th century. Especially during World War II, when the well-known Lend Lease Act of 1941 was committed to be the "Arsenal of Democracy". Under this Act, the United States provided \$48.5 billion in defense articles to assist her allies to fight against the Axis powers in Europe and Asia. [Ref. 1:p. 7]

After the Axis powers were defeated and the victorious Allies began drawing apart, the Soviet army remained in Europe, setting up subservient puppet regimes to buffer the Soviet Union from Western Europe. While in Asia, the Soviets seized China's sovereignty in Outer Mongolia, occupied Japan's northern Kuril Archipelago and created North Korea. Moreover, the Chinese Communists, with the material help of the Soviets, conspired and occupied the Chinese Mainland. Out of these actions emerged Stalin's Communist Empire. Since then, the world has developed into a sharp confrontation between free nations and totalitarian Communists.

In order to confront the Soviet threat, the free and democratic bloc of nations, headed by the United States, uses economic and military aid to help other nations strengthen

defenses against foreign encroachment. The Communist bloc nations impose their political system upon the under-developed and developing countries by using economic strangulation and subversion. The North Atlantic Treaty Organization (NATO), a system of "Bulwark of Anti-Communism" was established by 12 Western nations in 1950 to provide for a collective defense against a possible attack by the Soviets. On the Communist side, the Warsaw Pact of 1955 was signed when the Soviets tried to tighten control over the Eastern Communist regimes. Similarly, there are various bilateral and multilateral treaties or agreements between the United States and the Far Eastern countries in the Pacific Rim to prevent the spread of Communism in that part of the world.

The government of the Republic of China (R.O.C.) was forced to move its seat to Taiwan in 1949, creating a severe danger which continues to threaten Taiwan. The United States indicated it did not wish to become involved in the situation and announced publicly that it would no longer provide military aid to the R.O.C. [Ref. 2:p. 119]. When the Korean War broke out, the no-interference policy was quickly reversed. In late June, 1950, the United States ordered the Seventh Fleet to prevent any attack on Taiwan. In 1954, the Mutual Defense Treaty was signed between the United States and R.O.C. Unfortunately, owing to the complicated world situation, the United States decided to play its "China Card" to counterbalance the Soviet threat. In 1979 the United States

broke formal relations with R.O.C. and established diplomatic relations with the People's Republic of China (P.R.C.). The Mutual Defense Treaty was terminated accordingly.

Upon ending diplomatic relations with R.O.C., the American Congress passed the Taiwan Relations Act (TRA) of 1979 and stated that the United States "will make available to Taiwan such defense articles and defense services in such quantity as may be necessary to enable Taiwan to maintain sufficient self-defense capability [Ref 2:p. 68]." Chinese Communists reacted by saying that military force would be used to liberate Taiwan and warned Washington that if the United States continued to sell arms to Taiwan, the relations with Washington would be hindered and downgraded. The U.S. government was compelled to issue a U.S.-Communist China Joint Communiqué in 1982 which clearly declares:

The United States Government does not seek to carry out a long-term policy of arms sales to Taiwan and will not exceed, either in qualitative or in quantitative terms, the level of those supplied in recent years since the establishment of diplomatic relations between the United States and China, and that it intends to reduce gradually its sale of arms to Taiwan leading over a period of time to a final resolution. [Ref. 2:p. 88]

Under this China policy, the important question was how the R.O.C. could maintain its security under the TRA.

Since their seizure of the mainland, the Chinese Communists have regarded the island bastion of Taiwan as a thorn in their back which must be removed. But, the Taiwan Straits is a natural barrier between mainland China and Taiwan. Mainland

China needs time to build up its military capability to achieve the invasion goal.

On September 3, 1956, the Chinese Communists unsuccessfully tried to occupy the offshore Island Kinmen near the mainland coast. On August 23, 1958, they resumed shelling the island and conducted landing operations. The Communist's military operation to attempt the capture of the island was checked by the National Forces and it failed with heavy losses.

Today, the picture is quite different from that in the 1950s. Although the natural barrier still provides some protection to Taiwan, the Red's military strength is growing. The Red's navy has reached a strength beyond that required for protection of its merchant marine in time of war. It has more submarines than needed for home defense.

History teaches a clear lesson. Aggressive conduct, if allowed to grow unchecked and unchallenged, ultimately leads to war. Frequent military maneuvers by the Reds along the Taiwan Straits have proven that the Chinese Communists have never given up their attempt to invade Taiwan. Therefore it is absolutely necessary for the R.O.C. to have a strong defense system to maintain its security.

After World War II, South Korea and R.O.C. were the only countries in the Far East to remain split. The Korean Defense Minister, Lee Sang-Hoon, lately reported to President Roh that South Korea would develop its own modern weaponry and increase military research to cope with the reduction of U.S. troops.

Taiwan's situation is not comparable as it has no U.S. troops stationed on the island. This means that the R.O.C. government should improve its military strength so as to have sufficient and reliable deterrent capabilities.

The 1982 Communique which imposes limits on arms sales to Taiwan is detrimental to Taiwan's security. In the face of this grave situation, the R.O.C. has intensified efforts to develop and produce more of its own weapons while continuing to seek arms from the United States. Furthermore, Taiwan has begun its own research and development aimed at national defense self-sufficiency. Defense technology transfers to R.O.C. are the most suitable way for the United States to assist R.O.C. to facilitate self-sufficient capability for national defense. Stability in the Taiwan Strait concerns not only the survival of Taiwan, but is also in the best interest of the United States.

II. REVIEW OF THE U.S. FMS

A. GENERAL

The issues of arms sales are very complex. The supplier country has to consider many objectives, but there are two main objectives: political and economic. The political one outweighs the economic in importance.

The political objective of arms sales is to provide friendly nations or allies with suitable weapons to deter potential threats or to fight against actual foreign invasion. The transfer of arms is expected to create or maintain a regional balance of power for a stable environment in the interest of the supplier country as well as the foreign one. Without the threat of foreign encroachment, there would be no need to spend a huge amount of money on arms. This creates a tremendous burden on countries with limited resources and urgent economic and social needs. However, until a country is no longer endangered, it has every right to purchase weapons it deems necessary in order to safeguard and defend its existence.

The supplier country may seek commercial benefits or arms sales for hard currency to pay for other necessary imports. As a matter of fact, arms is a special kind of merchandise. The buyer country can get it somewhere, somehow - at a price - and

therefore, selling arms is a commercial activity, but more complex.

The United States has long been the world's largest supplier of arms and has had the greatest increase in sales. During the period of 1950-1979, it transferred abroad over \$100 billion (U.S. dollars) in arms and related military services, more than half of the world trade. Under the Reagan Administration, arms sales were emphasized as an instrument of diplomacy [Ref. 3:p.45]. The complexity and comprehensive factors involved in the determination of U.S. arms sales can be better understood as listed in the Department of Defense Security Assistance Management Manual [Ref. 1:p. 5].

Foreign Military Sales (FMS) support specific U.S. foreign policy and security objectives. Historically, sales have improved international order and increased the prospects for regional stability, thereby reducing the likelihood of direct U.S. military involvement. Standardization of material, doctrine, and training is enhanced among our allies and friends. Additional benefits stemming from foreign military sales are: the U.S. production base is maintained, U.S. employment is increased, research and development costs are spread, unit costs to the U.S. services are reduced, and forward material support is facilitated.

As mentioned above, arms sales must be considered essentially in political terms, no matter whether it is political, diplomatic, commercial, or something else.

B. CHRONOLOGICAL SEQUENCE OF FMS IN THE UNITED STATES

During World War II, the Soviet Union saw the opportunity to regain the territory once ruled by the Czar, and strived

for expansion. As a result of the War, Russia acquired (or reacquired) large amounts of territory in Europe along its eastern border. This acquisition of territory was passively accepted by the Western democracies. Along its southern border, however, the U.S.S.R. encountered resistance [Ref. 4:p. 46], i.e., the Azerbaizan Incident in Iran, the territory disputes between Turkey and Russia, and the Communist guerilla civil war in Greece. The United States was fully aware of the Soviet's ambitious attempt. On March 12, 1947, President Truman declared that the United States pledged to "support free people who are resisting subjugation by armed minorities or by outside pressure." This declaration became well known as the "Truman Doctrine," the turning point in American foreign policy. A few months after President Truman announced that the United States would give military assistance to Greece and Turkey, Secretary of State George Marshall announced in June 1949 that the United States would make available economic assistance to all the countries of Europe. This is known as the Marshall Plan or the European Recovery Plan. Some historians said that 1947 was the beginning of "Cold War."

The policy of containment to provide assistance to Greece and Turkey was the conception of the Military Assistance Grand Aid Program at a later date. The United States foreign policy is closely related to U.S. strategic concerns in the world. Its ultimate objective is to prevent the spread of Communism on a global basis. On January 12, 1950, the then-Secretary of

State Dean Acheson defined a "defensive perimeter" for the United States in the Pacific, running from the Aleutian Islands through Japan and then the Ryukyu Islands and the Philippines (Figure 1). Outside the perimeter were Taiwan and Korea.

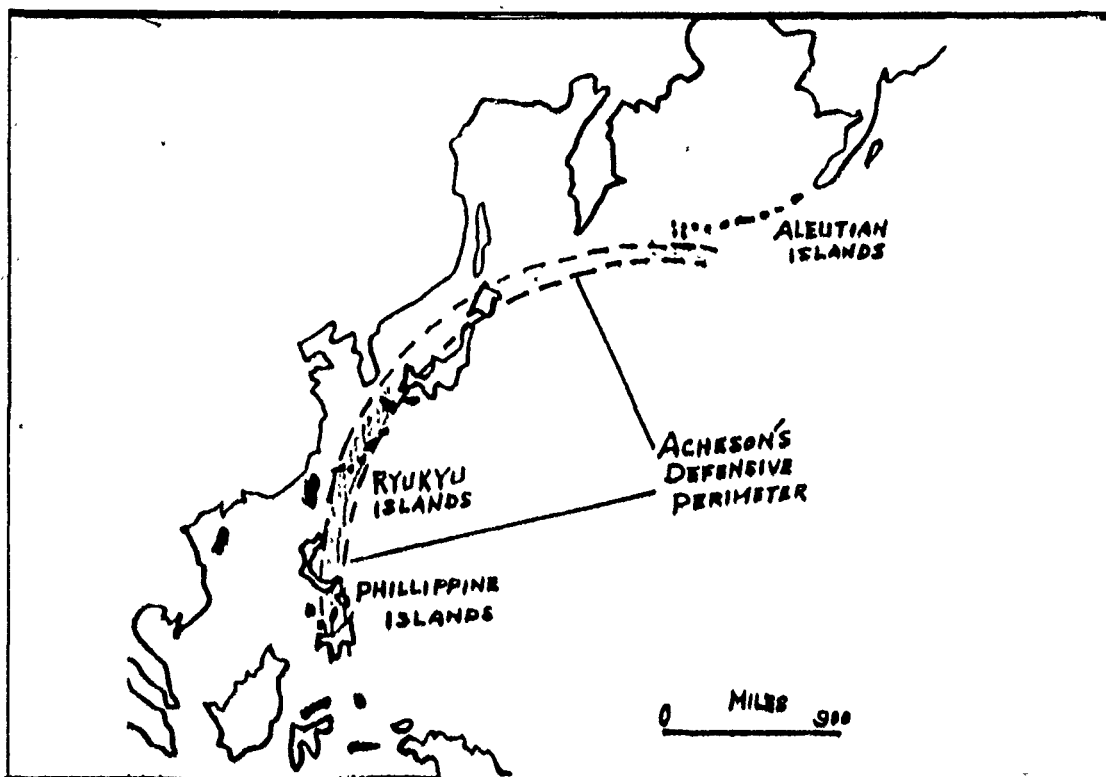


Figure 1. Secretary of State Acheson's Defensive Perimeter

The Soviets were much impressed by this perimeter and thus had opportunities to explore further expansion. On June 25, 1950, the Soviets urged North Korea to launch a massive attack on the South. America quickly assumed the role of leading power of the democratic world and went to war against the Communist aggression. President Truman said,

We had been tough in Iran, Berlin and Greece, and we must show the same toughness in Asia. Certainly, the

"Appeasement Diplomacy" can not stop the aggression which the British Prime Minister Chamberlain had tried to ease the tension before the start of World War II. The past history should have taught us this fatal lesson.

America is an extraordinary country, noted for its idealism and willingness to sacrifice narrow national interest for global benefits. The government of the United States realized that what happened in other countries would affect their security sooner or later. In view of the necessity of preventing the Soviet from extending its sphere of influence, the U.S. employed traditional instruments of foreign policy, such as alliances and economic assistance. The close ties inherent in the security relationship and strengthening the military forces of their allies and friendly nations not only can directly deter the Communist expansion but also enhance the security of the United States and world peace.

The North Atlantic Treaty Organization (NATO) was the first alliance treaty established in April 1949. Hence it successfully ended the Soviet expansion any further in Western Europe and the effect of this collective defense treaty was quite obvious. As the ultimate objective of Stalinization was to communize the free world and to bury the democratic countries, the expansion in the Western Group met with grave difficulty. They changed their course to Asia. In order to counter this situation, the Southeast Asian Treaty Organization (SEATO) was then organized by eight nations in

September 1954. The Central Treaty Organization (CENTO) consisting of five nations was signed in February 1955.

These three treaty organizations formed the "Bulwark of Anti-Communism," a great achievement of American policy of containment. Furthermore, there were various bilateral and multilateral defense pacts, security treaties between the United States and West Pacific countries, all aimed at preventing the spread of Communism in this part of the world. The United States stood up as a world power in both Europe and Asia.

Clausewitz, the well-known Prussian strategist in his 1827 treatise *On War* declared that "the war of a common society is the war of all people, particularly the war between civilized people which must be conceived in political status and stimulated by the political motive," and that war therefore, is "a political act." He went on further, "War is not merely a political act but also really a political instrument, a continuation of policy carried out by other means." This marks the beginning of the conception of modern "Cold War." Quite obviously there is an intimate relationship between war and politics. The concept of Clausewitz is that politics produced war, and war was the means to employ violence as the continuation of politics.

The instruments of violence are armaments and armed forces. Without arms there could be no war. International relations are the interaction of states. There are many issues in

international relations but war seems to be the major one. Vice-President Richard Nixon said in 1953, "If it were not for the Communist threat, the free world could live in peace."

[Ref 4:p. 136]

America assumed the leadership of the democratic bloc in countering the Communist expansion. Their consistent foreign policy was to supply the needed arms to the threatened country, either through a reimbursable or non-reimbursable security assistance program.

In the 1950s security assistance consisted mainly of surplus military stock of over-aged, technologically inferior equipment transferred through grants in aid or loans. This assistance was intended to support friendly foreign countries in establishing and maintaining adequate defense postures which were consistent with their economic stability and growth and to help them to maintain internal security and to resist external aggression. Basically, this was the philosophy of the Eisenhower Doctrine. [Ref. 5:p. 4]

In August 1964, a North Vietnam torpedo boat attacked a U.S. destroyer. Congress passed the "Tonkin Gulf Resolution" which authorized President Johnson to formally enter the war against North Vietnam. It was a rather unbelievable fact that, despite being materially worse off, North Vietnam was able to employ guerrilla tactics against modernized U.S. military power until a ceasefire in January 1973. The withdrawal of American troops in March 1973 led to the collapse of South

Vietnam in 1975. The long-time military engagement in Vietnam had brought about tremendously evil effects on both the economic welfare and social community in the United States.

When President Nixon was elected in 1969, U.S. commitment of troops in Vietnam was at the peak of 545,000 Americans. During that period, anti-Vietnam War campaigns created a regular furor throughout most American cities. The American foreign policy seemed to change from a policy of containment to "From Confrontation to Negotiation" [Ref. 6:p. 595]. The United States and the Soviet Union moved closer in a process called "detente." The term "detente" [Ref. 4:p. 420] has been frequently used since that time. The long and bloody Vietnam War was terminated during Nixon's term.

After two hot wars in Korea and Vietnam, America's economic strength began to decline. However, some European countries and Japanese economies had begun to recover. A sense of economic contraction thus began to reduce the scope of American military power.

President Nixon, in remarks on Guam during a world trip in 1969, suggested that henceforward the United States would supply arms but not soldiers. The "Nixon Doctrine," as it was called, has been followed by Nixon's successors as well, with United States arms transfers remaining high but with United States troops by and large being kept out of military engagements since the Vietnam War ended. [Ref 4:p. 459]

The economic position of the United States continued to weaken until 1971 when it ran its first trade deficit since before World War II [Ref. 4:p. 512]. Although the United States was still heavily involved with security assistance, during the Nixon and Ford years the emphasis shifted from Military Assistance Programs (MAP) and Grant Aid to Foreign Military Sales (FMS) [Ref. 5:p. 5]. Since then, the arms transfers have become predominantly sales rather than grants.

Figure 2 shows the United States arms sales between 1970 and 1980. The amounts cited as sales include not only weapons but supporting equipment, spare parts, and services such as construction and training (these could amount to as much as 40% of the total package). Military assistance grants, as opposed to sales, declined from less than \$2 billion in 1970 to a mere \$265,000 in 1976. To many critics, arms sales policies under the Nixon and Ford Administrations had gotten out of control. Indeed, it often seemed as if there was no coherent arms transfer policy at all. [Ref. 3:p. 46]

One of the important legislations regarding the Foreign Military Sales Program that should be mentioned here is the International Security Assistance and Arms Export Control Act of 1976 (AECA). In general, the AECA defines the statutory purpose for sales of defense articles and defense service to allies and friendly foreign governments in accordance with the restraints and controls specified and for furtherance of the security objectives of the United States. Furthermore, the

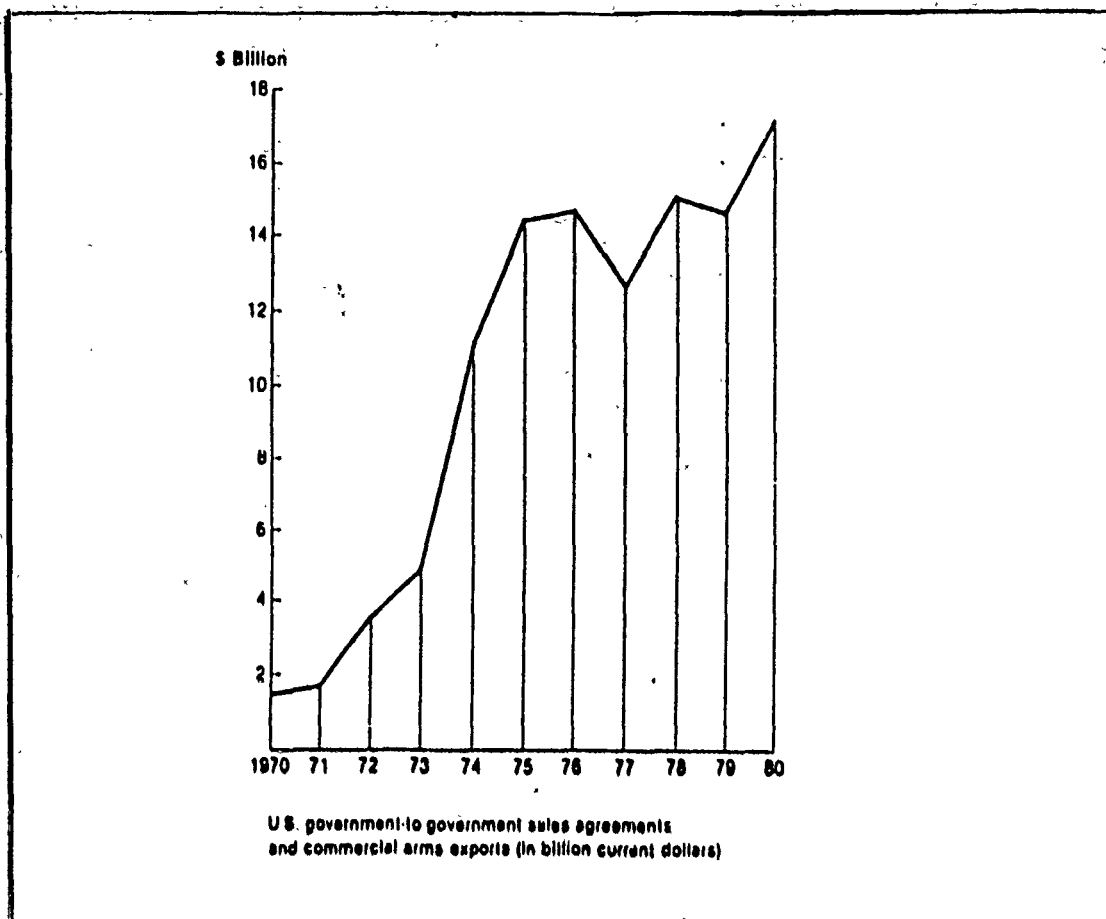


Figure 2. United States Arms Sales, 1970-1980

AECA prohibits transfers to any country "which engages in a consistent pattern of gross violations of internationally recognized human rights" except in extraordinary circumstances.

The Act requires that the president make an annual country-by-country evaluation for the Congress on human rights conditions to aid it in making judgements on security assistance. Since then, human rights have become one of the major criteria for applying arms sales project.

The International Security Assistance and Arms Export Control Act which has been amended annually since 1976 was the most significant piece of legislation dealing with arms transfers since the enactment of the Mutual Security Act more than a quarter of a century earlier. It sought to "shift the focus of U.S. arms sales policy from that of selling arms to controlling arms sales and export." [Ref. 3:p. 50]

The excesses of American arms sales were the source of much unease. America became the "Arms Merchant of the World" or "Arsenal for the World" [Ref. 3:p. 45]. Through this Act, Congress secured its role in dealing with the process of arms transfers and gave voice to its continuing interest in restraints.

The Carter administration's policy on arms transfer was one of restraint. He pledged: "Henceforth arms transfers were to be viewed as an exceptional foreign policy instrument, to be used only in instances where it can be clearly demonstrated that the transfer contributes to our national security interests." [Ref. 3:p. 52]

To implement the policy, a set of qualitative and quantitative controls was established. In addition, the human rights within recipient countries would be a consideration in future security assistance programs. Finally, there was to be a dollar ceiling on the volume of new commitments for foreign military sales and military assistance programs, with the

total for fiscal year 1978 to be less than the previous year [Ref. 3:p. 53].

The following are six provisions which served as guidelines for Foreign Military Sales:

1. The United States would not be the first supplier to introduce into a region newly developed, advanced weapons systems that would create a new or significantly higher combat capability.
2. The United States would not sell newly developed advanced weapons systems until they were operationally deployed with U.S. forces.
3. The United States would not permit development or significant modification of advanced weapons systems solely for export.
4. The United States would not permit co-production agreements with other countries for significant weapons, equipment, and major components.
5. The United States would not allow U.S. weapons or equipment to be transferred to third parties without U.S. government consent.
6. The United States would require policy-level authorization by the Department of State for actions by agents of the United States or private manufacturers that might promote the sale of arms abroad.

The above restrictive guidelines were not to apply to transfers to countries with which the United States has major defense treaties - NATO, Japan, Australia, and New Zealand.

Carter's policy was motivated by idealism and the difficulty of regulating the flow of arms sales in practice. Figure 2 clearly shows that the reality of arms sales under the Carter Administration increased overall. It was an ambitious policy, comprehensive in scope and detail. A country

requesting arms sales would could be carefully considered and scrutinized for their full implications.

The Reagan Administration's approach toward arms sales exemplified a major differences between its foreign policy and that of preceding administrations. The Reagan Administration viewed the transfer of conventional arms as an essential element of the U.S. global defense posture and an indispensable component of foreign policy [Ref. 3:p. 62].

The Reagan Administration also increased military spending and support for insurgents against Communist governments. The press labeled such support as "the Reagan Doctrine" [Ref. 4:p. 459]. The Reagan Doctrine could be seen as the application of the Nixon Doctrine to covert action, that is, letting others do the fighting while the United States supplied the material [Ref. 4:p. 460].

It seems clear that the Reagan Administration was relaxing the arms sales control which had been imposed by the previous administration, and face up to the realities of Soviet aggrandizement with a sober, balanced, and responsible arms transfer policy to protect the interest of the U.S. national security.

The United States went through two World Wars plus the Cold War. It goes without saying that if America did not supply huge amount of arms or enter wars, the world situation would be much different and all the free people would be living in a miserable world. A leading East German psychiatrist said

that 40 years of hard-line communist rule had made many of the country's people mentally ill. The ailments range from sadness to "murderous anger and hatred [Ref. 7:p. 2]."

America is an extraordinary country with traditional unique thought as specified in its Declaration of Independence: "We hold these truths to be self-evident, that all men are created equal, that they are endowed by their CREATOR with certain inalienable rights, that among those are LIFE, LIBERTY, and the pursuit of HAPPINESS."

President Truman announced that the United States would assist "free people everywhere." Though the Truman Doctrine was seen by the free world as a program to prevent Soviet interference in Greece and Turkey it was motivated by the traditional idealism which can be seen further in President Kennedy's ideas about international relations.

President Kennedy expressed the same American sense of mission when he said, "Let every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe to assure the survival and success of liberty [Ref. 8:p. 16]."

In his inaugural address, he declared that a new generation of Americans was "unwilling to witness or permit the slow undoing of those human rights to which this nation has always been committed, and to which we are committed today at home and around the world." For Americans, these human rights were, above all, the civil liberties enumerated by the first 10

amendments to the United States Constitution, and particularly freedom from arbitrary arrest and detention, from torture, and from summary execution [Ref. 4:p. 454]. Since then, human rights is the primary concern of American foreign policy.

In view of the complexity and diversity in the evolution and implementation of the United States Security Assistance Programs, this study tries to draw out a clear and concise picture regarding the FMS by looking at historical background after World War II. The following is a brief summary for easy grasping about FMS.

1. U.S. Security Assistance Programs fall into three general categories: Support Assistance, Military Assistance Program (MAP), and Foreign Military Sales (FMS). Of the three, two are completely military in nature, i.e., the MAP and FMS programs, which are under Defense Department administration, in coordination with the Department of State. MAP involves no cost to the recipient country, whereas FMS are sales for cash or credit repayable in U.S. dollars within 12 years [Ref. 5: p. 10].
2. FMS and other elements of the Security Assistance Programs are the effective instrument of global defense picture and indispensable component of U.S. foreign policy which can be seen from the statement made before the House Committee on International Affairs by William P. Clements, Deputy Secretary on 11 November 1975. The statement reads as:

The principal purpose of Security Assistance ... both the grant aid and the Military Sales Programs ... is to strengthen deterrence and promote peaceful resolution of international issues by helping our friends and allies to maintain adequate defense forces of their own. ... If we achieve regional stability in crucial areas of the world without the need for direct intervention by American forces, then, our security assistance efforts have been rewarded.

Even five years later, 19 January 1981, Secretary of Defense Harold Brown reported to the Congress that at

the end of 1980 approximately 99 countries and three international organizations were authorized to participate in FMS and revitalized the necessity of this program, he declared:

Security assistance will continue to play an important role in assisting friends and allies in meeting their essential defense requirements for the foreseeable future The more likely scenario is that these programs will expand to meet changing international security requirements" [Ref. 5:p. 12]

3. FMS are authorized only when the sales best serve the national defense and foreign policy interests of the United States and to ensure that other free and independent countries with valid requirements for effective and mutually beneficial defense relations are encouraged to maintain and foster an environment of international peace and security.

Finally, it should be reemphasized that arms sales must be considered essentially in political terms. In the arena of foreign policy, DoD alone cannot decide whether or not a sale is in the national interest. The mission of the DoD concerning FMS is judicious sales of defense articles and services and supporting the foreign policy of the United States. Therefore, all transactions must be approved by the Department of State.

III. THE SECURITY OF THE REPUBLIC OF CHINA AND U.S. ARMS SALES

A. GENERAL

Facing its long-time adversary, the ROC has experienced economic, social, and political progress unmatched almost anywhere in the developing countries over the past 40 years. Although under military threat from Communist China, the ROC government has firmly vowed to stay in the democratic camp and has refused any possibility of entanglements with any communist regime since the Carter Administration terminated its formal relations with ROC in 1978. In considering the strategic picture in East Asia, a secure and prosperous government in Taiwan coincides with the interests of the United States, Japan, Western Europe, the Republic of Korea, and ASEAN countries.

However, with its limited resources and defense technology, the ROC will be in a difficult position to maintain a credible military deterrent sufficient to discourage any military action by Chinese Communists by the end of the 20th century when Peiping plans to accomplish its military modernization. The Island's military strength will not be able to serve as an effective regional force to monitor and help control Soviet naval and air activities in the face of Moscow's growing military buildup in the Western Pacific. So the U.S. policy of

arms sales to Taiwan is very important for the defense needs of ROC.

B. THE STRATEGIC VALUE OF THE REPUBLIC OF CHINA

With the rapprochement between the United States and Communist China since early 1970, the strategic value of Taiwan to the free world has been largely forgotten. Indeed, the strategic importance of the Island is much greater than is generally recognized in the United States.

During the Korean War in the 1950s, General Douglas MacArthur emphasized repeatedly that defending the Island was very important to American interests. He compared the ROC to an unsinkable aircraft carrier that could never be replaced by any existing U.S. Navy aircraft carriers. In a speech to the U.S. Congress following his dismissal, General MacArthur expressed the extreme view that the loss of the Island might force U.S. western frontiers back to the coasts of California, Oregon, Washington.

Geographically, Taiwan is located in the outer edge of the East Asia continent, and occupies the central position of the island-chain-defense of the Western Pacific (Figure 3). It is the pivotal point in the sea line communications of Japan and the Republic of Korea. Almost all of the crude oil and raw materials needed by Japan and by Korea must be shipped through the peripheral waters off Taiwan. Thus, the strategic location of Taiwan plays a critical role in their economic development.

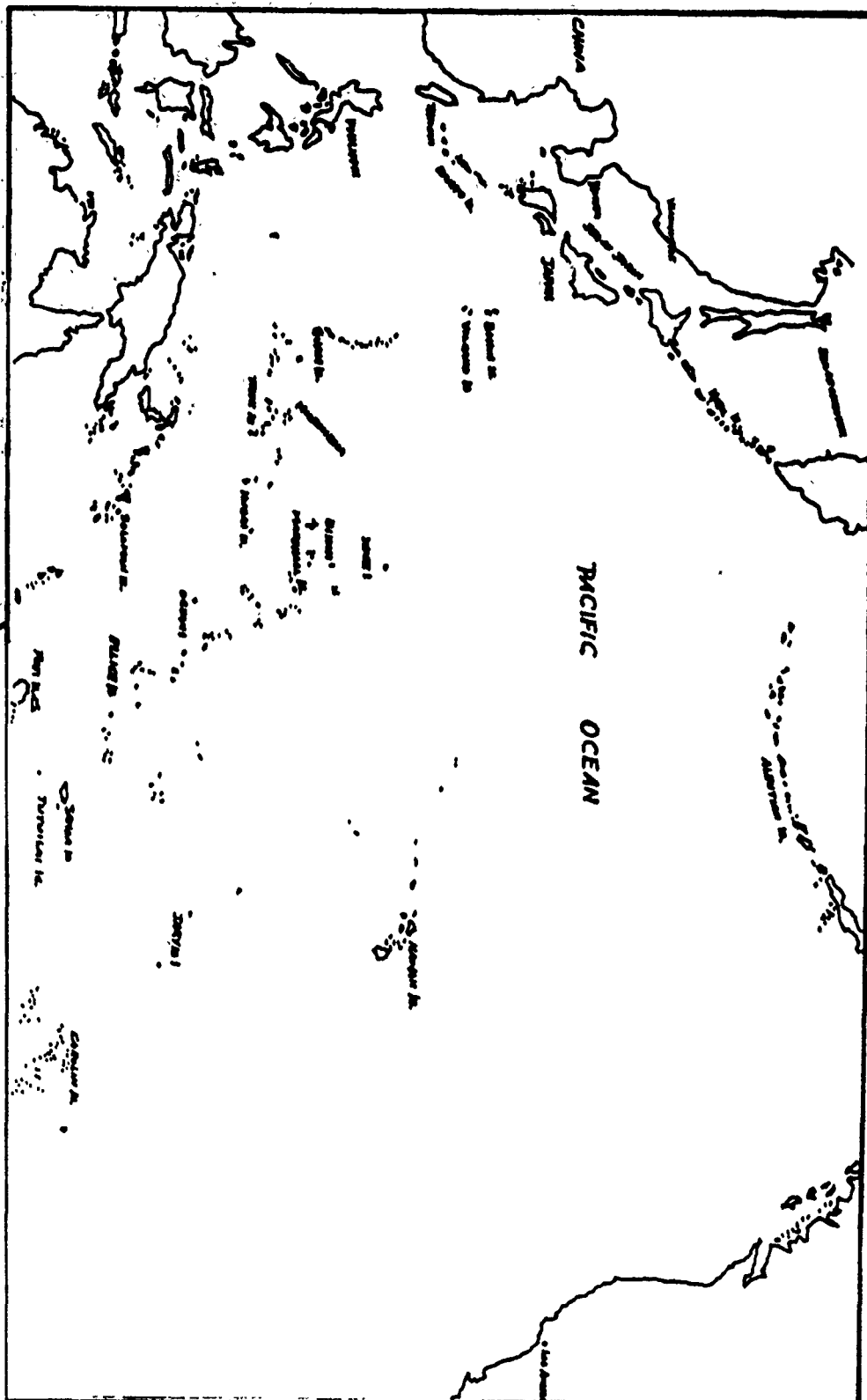


Figure 3. Island-chain defense of the Western Pacific

This has been especially true since the Soviet occupation of Cam Ranh Bay, Vietnam.

Undoubtedly, the Soviet military expansion in East Asia adds a new dimension seriously jeopardizing the military balance and security in this part of the world. However, Taiwan controls both the Taiwan Strait and the Bashi Channel, through which the Soviet Far East fleet must pass from Vladivostock to Cam Ranh Bay. Therefore, the island can severely limit the effectiveness of the Soviet's sea power. Moreover, with excellent air bases, sea ports and an extensive industrial base, Taiwan is capable of supporting and substantially reinforcing air and sea operations in the Western Pacific. In other words, the stability of the ROC means the security and safety of the West Pacific Ocean. If Taiwan should be occupied by the Communists or other unfriendly power, the chain of defense in the West Pacific Ocean would collapse like dominoes [Ref. 9:pp. 5-6].

The economic performance of the ROC over the past 40 years has been an international miracle. The trade records last year made the ROC the 12th largest trading country in the world [Ref. 10:p 70]. As for its future economic development, several factors are beneficial to the ROC: a well-educated work force; the rapid development of a strong defense industry; a stable environment of promoting both public and private investment, and offering more incentives for foreign investment. In short, the ROC is in a unique position not only

to deter the expansion of communism in the West Pacific, but also to contribute its efforts to developing democratic politics.

C. COMMUNIST CHINA'S CURRENT STRATAGEM AGAINST THE ROC

It is very clear that Communist China has never ruled out its intention to gain control of ROC. Since 1949 there have been four major attempts by Peiping's leaders to try to gain political control over the ROC. The four stages of political control in the ROC are:

1. 1949-1954 Armed Liberation of Taiwan
2. 1955-1971 Peaceful Liberation
3. 1972-1979 Isolation of Taiwan
4. 1980-Now Peaceful reunification

Prior to the normalization of relations with the United States, Communist China publicly announced that military forces would be used to achieve the so-called reunification. According to the People's Daily of 20 December 1987, Ten Hsiao-ping raised the so-called one-country/two-systems proposal which allows Taipei to maintain its armed forces and even its unofficial ties with foreign countries. It is obvious that Peiping has tried to create a false image of peaceful reunification. The attempts behind its mask are to isolate the ROC; in particular to persuade the U.S. administration to stop arms sales to Taipei and to weaken the anti-communist

determination of the ROC. Peiping's ultimate goal is to communize the Island, a goal which they have never abandoned.

Although the United States has committed itself to the security of Taiwan through the Taiwan Relations Act, Peiping has warned that it would downgrade its relations with Washington if the United States continues to sell weapons to the ROC. In December 1980, Peiping threatened the Reagan Administration in a manner similar to the reduction of the Hague's representation to the level of charge d'affaires as a result of the decision by the Dutch to sell two Swordfish-class submarines to the ROC. In response to Peiping, on August 17, 1982, the Reagan Administration felt compelled to issue a U.S.-Communist China Joint Communiqué that gave the appearance of a readiness to restrict U.S. arms sales to the ROC to both a specific dollar ceiling and a qualitative level with the apparent ultimate intention of terminating such sales entirely at some unspecified time.

Peiping is also trying to undermine the ROC's diplomatic status in the international community. Peiping has designed to portray the ROC as a local government that needs to be reintegrated with the mainland as soon as possible. In summary, diplomatic isolation, economic pressures, and psychological warfare on a thousand fronts are all part of Peiping's current indirect stratagem against the ROC and its efforts to force the ROC into a reconciliation on communist terms.

D. REINFORCE NAVAL STRENGTH, CORNERSTONE OF TAIWAN'S SECURITY

When examining the ROC's long-term threat from Communist China and the increasing Soviet military buildup in the Pacific Area, however, ROC defense capabilities are marginal and need to be considerably enhanced. (Almost all the ROC's ships and aircraft were received from the United States. Many had been in service by the United States Navy since World War II. Even with proper maintenance, rebuilding and modernization, the ships will need to be retired soon.) Despite the fact that the ROC is currently giving priority to speeding up its own defense industry and is looking for additional sources of supply for advanced weapons, the United States is still and will continue to be the major arms supplier to Taiwan. According to the Taiwan Relations Act in Section 2(b) and Section 3:

Section 2.

(b) It is the policy of the United States -

(1)

(2) to declare that peace and stability in the area are in the political security, and economic interests of the United States, and are matters of international concerns;

(3)

(4) to consider any effort to determine the future of Taiwan by other than peaceful means, including by boycotts or embargoes, a threat to the peace and security of the Western Pacific area and of grave concern to the United States;

(5) to provide Taiwan with arms of defensive nature; and

(6) to maintain the capacity of the United States to resist any resort to force or other forms of coercion that would jeopardize the security, or the social or economic system, of the people on Taiwan.

Section 3.

(a) In furtherance of the policy set forth in Section 2 of this Act, the United States will make available to Taiwan such defense articles and defense services in such

quantity as may be necessary to enable Taiwan to maintain a sufficient self-defense capability.

(b) the President and Congress shall determine the nature and quantity of such defense articles and services based solely upon their judgement of the needs of Taiwan, in accordance with procedures established by law. Such determination of Taiwan's defense needs shall include review by United States military authorities in connection with recommendations to the President and the Congress.

(c) The president is directed to inform the congress promptly of any threat the security or the social or economic system of the people on Taiwan and any danger to the interests of the United States arising therefrom. The President and Congress shall determine, in accordance with constitutional process, appropriate action by the United States in response to any such danger.

In other words, the United States will make available to Taiwan defense articles and defense services in such quantity as may be necessary to enable Taiwan to maintain a sufficient self-defense capability. The United States has continued to sell weapons to the ROC. And the volume of arms sales (Table I) showed the U.S. willingness to carry out its promise toward the ROC.

The United States provided about \$5.2 billion in grants or sales from 1950 to the end of 1979. As grant assistance ends, all arms transfers must be made by FMS. From Table I it is worthwhile to mention here that the values of commercial sales have grown significantly and the total values decrease yearly.

But the military balance in the Taiwan Strait has had significant changes in recent years. With its rapid development of high performance fighters, such as the F-8, F-10 and F-12 Communist China will be capable of taking air superiority over the Taiwan Straits by the end of the 20th

TABLE I. VALUE OF U.S. ARMS SALES TO TAIWAN (IN MILLIONS OF U.S. \$)

FISCAL YEAR	FMS	COMMERCIAL EXPORTS	TOTAL
1979	598	-	598
1980	287	-	287
1981	295	-	295
1982	600	-	600
1983	698.6	85	783.6
1984	688.7	70	758.7
1985	700.4	54.5	754.9
1986	510.8	228.4	739.2
1987	509.6	210.0	719.6
1988	-	-	-
1989	495	185	680*
1990	-	ceiling	660*

* Jane's Defense Weekly, 6 January 1990, p. 35.

century. In addition, at least 10 air bases on the Chinese Mainland are within a 250-nautical mile operational radius from Taiwan. Should Communist China mount an offensive against the Island, each field could serve and support an estimated 150 combat aircraft or a total of roughly 1,500. Undoubtedly, all those aircraft which don't include those deployed at the northern China, will threaten directly the security of the ROC which presently has less than 400 fighters, mostly composed of F-104s, F-100s, F-5A/Bs and F-5Es.

Taiwan also faces a tremendous threat from Communist China's navy. This threat can be divided into three components: surface fighting vessels, submarines, and

amphibious ships. Among them, what the ROC navy is most concerned is Communist China's surface fleet, particularly the vast missile boat fleet and large submarine inventory. Of all the threats from sea, perhaps the most serious is the possible blockade by submarines which would smother the Island's economic development. The ROC's current surface fleet is at a distinct disadvantage against both the surface and submarine fleet of the Communist China.

After reviewing the current military situation, the primary operation of the Republic of China will be to retain air superiority over the Taiwan Strait under all possible attack, and to maintain the sea line off Taiwan Strait.

Ships in the ROC's current force consist of platforms received from the United States after World War II. Therefore, the age of the ships and weapon systems are rendering them obsolete as defense platforms. Despite intensive maintenance on its aging force, these ships need to be replaced by a second generation.

It's difficult to get new jet-fighter and war-ship technologies because of: 1) A lack of formal diplomatic relations with countries that process the needed technology, and 2) Communist China uses its diplomatic influence to block technology transfer.

After several years of ship-building experience and economic progress, ROC plans to develop its self-sustaining defense industry so that it will not need to rely on foreign

influences to upgrade its defense forces. This will be accomplished by introducing U.S. ship-building technology.

The project can enhance the ROC's national defense industry by training designers and engineers in the latest design methods so that future warships can be designed in the ROC.

IV. CULTIVATION OF NAVAL SHIP DESIGN

A. GENERAL

The ROC Armed Forces have been generously equipped by the United States for many years. After the normalization of relations between Washington and Peking at the end of 1978, a serious situation was created for Taiwan. Arms sales have been a problem because the Agreement signed between the United States and P.R.C. in August 1982 clearly indicated that the U.S. would reduce arms sales to Taiwan with the eventual purpose of totally ending those sales. Nobody can predict with certainty when and how the arms sales to R.O.C. will be terminated.

Realizing this crisis, the ROC government decided to increase military expenditures and develop its own defense industry in order to fulfill self-sufficiency and reduce dependence upon procurement abroad. The development of the IDF "Ching Kue" jet fighter was carried out successfully. The M48H tank unveiled on April 14, 1990, and christened "Brave Tiger" was jointly developed by the Armor Research and Development Center and a U.S. firm, General Dynamics Co. It took seven years of research and is now in production. The tank is regarded as more sophisticated than the U.S.-made BG0A3.

According to official reports, about 450 tanks will be produced.

Although research and development programs for these major military weapons have been accomplished, the naval combatant vessel, FFG program, is just at the starting stage. CSBC will undertake the construction. The complete design was purchased through U.S.F.M.S. Technical Data Package (TDP). The construction is launched in cooperation with the U.S. Bath Iron Works Shipyard (BIW) which provides both technical and procurement support service in order to facilitate the construction and deliver the vessels to the Navy on schedule.

B. TAIWAN SHIPBUILDING INDUSTRY

Before World War II, there was only one full-sized shipyard in Taiwan which was located in Keelung, in the northern part of Taiwan. After rehabilitation, it became Taiwan Shipbuilding Corporation (TSBC), a state-owned shipyard to build small fishing vessels. In 1957, TSBC built four steel 350 G/T fishing vessels under technical cooperation with Niigata Shipyard of Japan. For further development and expansion, TSBC was reorganized as Ingalls Taiwan Shipbuilding and Dry Dock Co. to be jointly operated with the U.S. Ingalls Shipbuilding Corporation. Two 36,000 DWT tankers were constructed between 1957 and 1962.

In 1962, TSBC retrieved the management. A technical cooperation with Ishikawajima-Harima Heavy Industries C. Ltd.

(IHI) of Japan was arranged. A series of medium-size bulk carriers and 100,000 DWT tankers were built then. By the end of January 1978, TSBC had built various types of ships with a total aggregated tonnage of over 2,450,000 DWT.

In 1973, another shipyard, China Shipbuilding Corporation (CSBC) was established in Kaohsiung, in the southern part of Taiwan, to further strengthen the national shipbuilding capabilities. Two 445,000 DWT tanker VLCC were built in 1977 and 1978. Following the oil crisis, the world shipbuilding industry was faced with long worldwide shipbuilding recession. TSBC was thus merged in CSBC in the year of 1978.

CSBC has accumulated over 30 years of experience in building various types of merchant ships and built more than 50 naval ships, including Fast Attack Boats (FAB), Troop Transport Ships (AP) and Fleet Replenishment Vessels (AOE). However, the design of these ships built by CSBC was mostly purchased abroad.

For accelerating the development of domestic shipbuilding industry, the United Ship Design and Development Center (USDDC) was established on July 1, 1976. As of this date, 71 ships of 22 designs have been constructed with a total aggregated deadweight of about 2,300,000 DWT.

Today, Taiwan is one of the important shipbuilding countries in the world and ranked No. 6 in the world shipbuilding industries [Ref. 11:p. 6].

C. OUTLINE OF U.S. NAVAL SHIP ACQUISITION PROCESS

The United States, a seafaring nation from its inception, relies on the world's oceans for its economic vitality and military strength. Its maritime strategy seemed to be aimed at defense of its territory as far from their own shores as possible, and preparation and planning for global warfare to be waged in conjunction with its allies. It is obvious that the need for strong naval forces and the planning for its employment is based on the larger, overarching requirements. The well-known U.S. "600-Ship-Navy" is the outcome of its maritime strategy.

Generally, naval ships are required to perform specified missions. Before acquisition, they must have an operational analysis which includes a threat analysis or study of expected enemy actions, methods or mode of attack, etc. From the threat analysis it is determined what must be done to meet or counter the threat. This in turn results in a state of Operational Requirements (OR) to specify the ship's missions and tasks and states the desired operational characteristics. The OR is then sent to the engineering or design organization to perform the design and construction in traditional sequence.

The American naval ship acquisition process is rather complex and lengthy. The whole process is an extensive and important subject which far exceed the scope of this paper. But, a general understanding of the process recognizes the importance of ship design in the whole process, especially the

logic and orderly tackling the multi-year multi-million dollar acquisition is of valuable guidance for other navies in planning their naval ship building program.

The U.S. Navy Ship Acquisition Process involves many personnel within Naval Sea Command (NAVSEA), other Navy agencies and industry. NAVSEA is responsible for the ship acquisition program. The organization of NAVSEA is shown in Figure 4. NAVSEA 03 and 05 were merged into a single organization 05 renamed the SHIP DESIGN AND ENGINEERING with three major groups as shown in Figure 5. When a new ship project arises, a project manager is designated from one of three platforms, depending on the type of ship, as the Ship Acquisition Project Manager (SHAPM) to handle the project. At the same time, a ship design manager (SDM) is designated by NAVSEA 05 to cope with SHAPM for the design and engineering of the project.

It is very important for NAVSEA (SHAPM and SDM) to find out precisely from the Tentative Operation Requirements (TOR) issued by the Chief of Naval Operation (OPNAV) what they want for the ship. NAVSEA first responds to the TOR with a Development Option Paper (DOP) which is a kind of preliminary proposal that states the feasibility and estimated cost of a ship that will potentially meet the TOR. The feasibility/conceptual studies performed to provide data for the DOP may last for a part of a year. The DOP is then sent back to Ship Characteristic and Improvement Board working

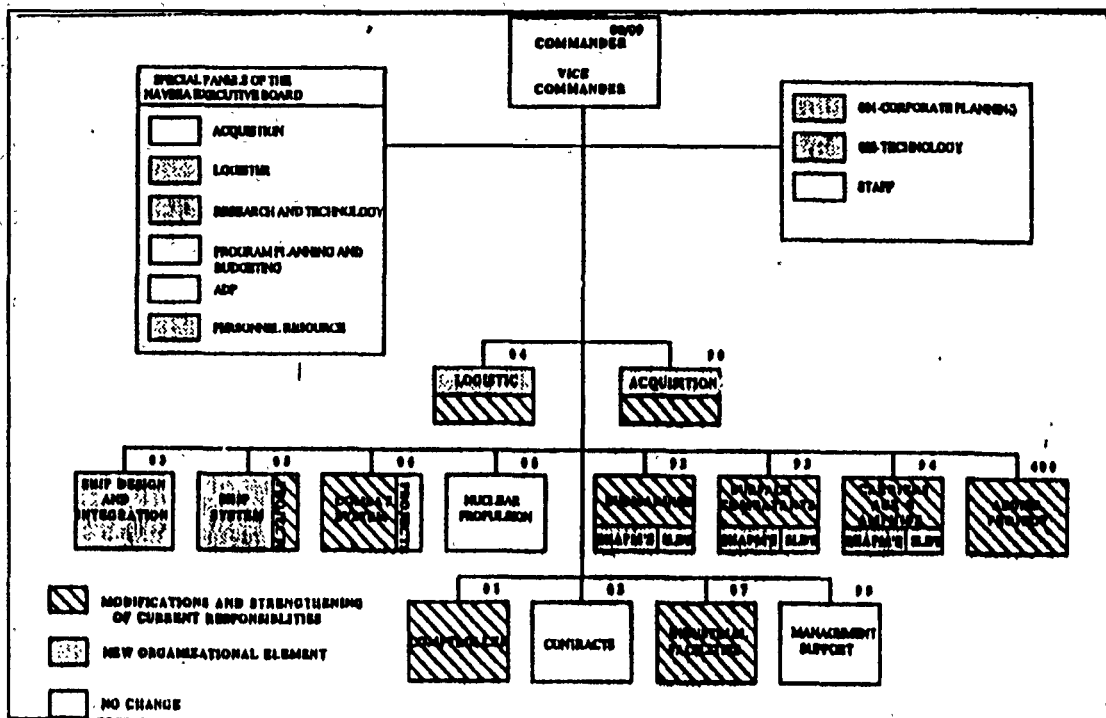


Figure 4. The Organization of NAVSEA Beginning on 8 April 1979

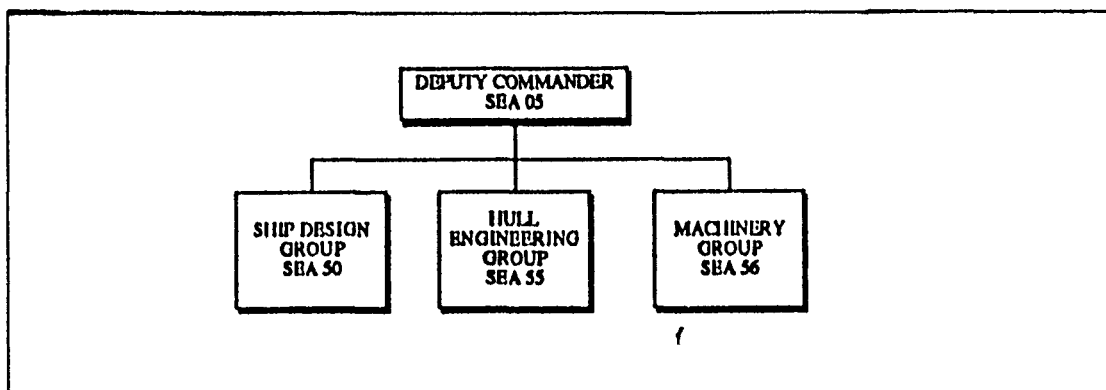


Figure 5. Naval Ship Design and Engineering Directorate 1982 Organization

group, which is established for each potential ship review. So far, this is the first round approach between operator and designer. Here, the author would like to define the "characteristics" of a ship. The characteristics of a ship are the ship's properties which include physical properties like

displacement and length, payload items like weapons, ammunition radars, etc., and performance requirements like endurance, speed, and seaworthiness. All those properties are of much concern for a ship's capability to carry out her missions. Figure 6 shows the dialogue between OPNAV and NAVSEA to finalize the characteristics of the project ship and its cost to help the ultimate customer (CNO) decide what the Navy will buy. There are many parameters that influence the performance and characteristics of the ship and its cost accordingly. Under CNO there is a Ship Characteristics and Improvement Board (SCIB), with the help of a working group to review this critical matter and make appropriate decisions in good times so as to facilitate the smooth flow of the process. Figure 7 shows ship characteristic chain of command and permanent members of the Board.

The Contract Design is primarily concerned with a "Conceptual" definition of the ship-manifest in the ship specification and contract design drawings, the principle product of this phase to enable bids on the construction of the ship.

Figure 6 is actually a design process in the Ship Acquisition Program. It shows the importance of the design efforts in the whole program. The final result, Contract Design is the legal document for bidding and final ship contract.

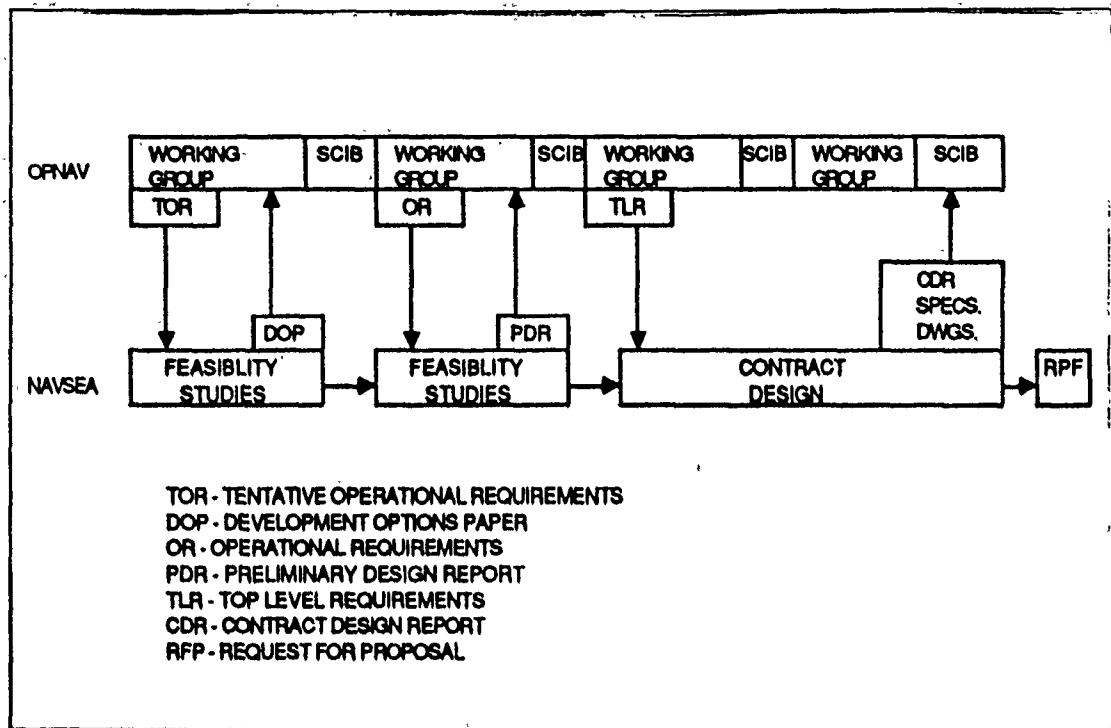


Figure 6. Operator/Designer Dialogue

The U.S. Navy is the biggest Navy in the world. They need many types of ships for deploying over the oceans. Other countries with small navies have to simplify the process to suit their own environmental conditions. Though it is complex and lengthy, the philosophy and orderly sequence is very instructive, and the timely concerted efforts of various involved personnel in the schedule is also important.

Table II [Ref. 12:p. 23] shows a Ship System Design, which summarizes the objectives, products and process of three design phases in a tabular form. Section C of Table III shows a Typical Destroyer Design which shows the historical information of the typical project. Though the two figures are referenced to a typical destroyer design, for other ship types

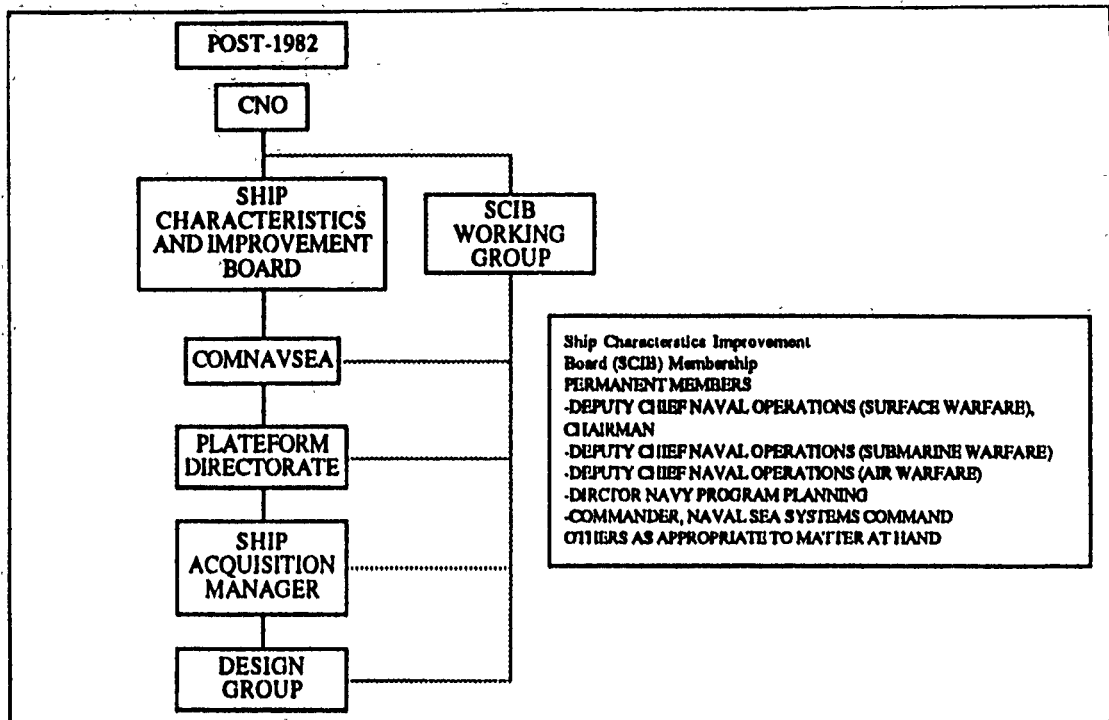


Figure 7. Ship Characteristic Chain of Command

it will be similar, varying only in proper (design cost, number of men and time in month) and product (addition or deletion) as listed in the column of ship system design. These two figures are of valuable information about U.S. Naval Ship Acquisition process and can be used as a supplementary description to conclude the topic of, this section.

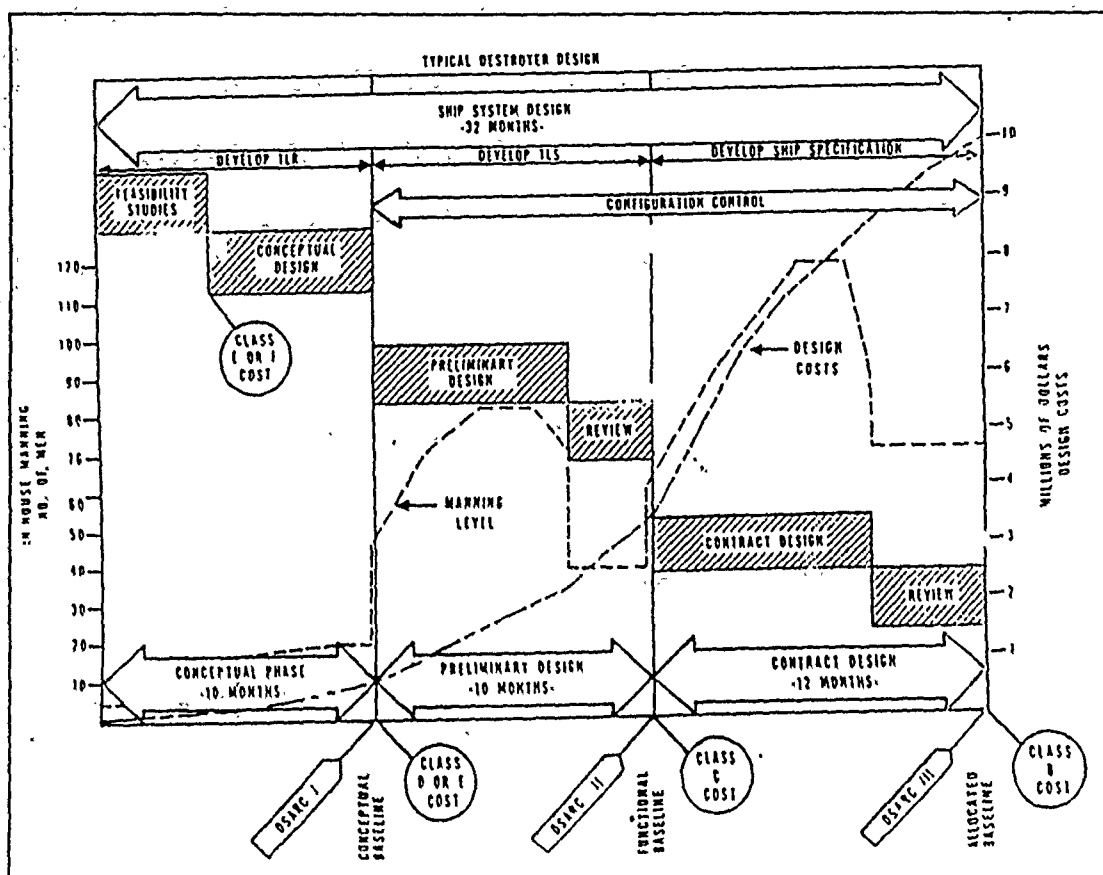


Figure 8. Typical Destroyer Design

TABLE II. SHIP SYSTEM DESIGN

		OBJECTIVES
C O N C E P T U A L P H A S E	FEASIBILITY STUDIES	<ul style="list-style-type: none"> a- to define a series of feasible ships, with associated production costs, which meet, or approach, initial performance requirements b- to achieve a balance between operational requirements (based on companion military effectiveness studies) and production costs (i.e., to determine most operationally cost effective alternative) c- to select, from the alternatives defined, a ship for Conceptual Design ("Concept Selection") d- to assure definition of alternative ships to the level required for a Class E (Class F for less reliable results) cost estimate e- to identify the major technical risks associated with alternative ships
	CONCEPTUAL DESIGN	<ul style="list-style-type: none"> a- to provide a technical baseline (Conceptual Baseline (CBL)) for DSARC I for new major combatant or developmental designs b- to assure definition of the ship to the level required for a Class D cost estimate (provides a basis for setting a design-to-cost goal by OPNAV) c- validation of feasibility study results - provision of a firm baseline for initiation of Preliminary Design (size, weight and cost should only be "reduced" in Preliminary and Contract Designs) d- initial resolution of major technical risks identified in the Feasibility Studies
PRELIMINARY DESIGN		<ul style="list-style-type: none"> a- to provide a technical baseline (Functional Baseline (FBL) for DSARC I or II b- to assure definition of the ship to the level required for a Class C cost estimate (lowest budget quality estimate) c- to achieve a complete engineering description of an integrated ship system such that the basic ship size and definition will not change during Contract Design d- to achieve functional definition of integrated subsystems selected for optimization of total ship performance and cost e- to select final design criteria for whole ship entity characteristics such as noise and ship protection consistent with cost and performance optimization of the total ship
CONTRACT DESIGN		<ul style="list-style-type: none"> a- to provide a technical/contractual baseline (Allocated Baseline (ABL)) suitable for DSARC II or III b- to assure definition of the ship to the level required for a Class B and/or Class A cost estimate (validation of "design-to-cost") c- complete translation of the FBL "engineering" definition of the ship to a contractual "biddable package" d- general validation of FBL ship system and subsystems through increased level of definition

K.B. Spauling, and A.F. Johnson, "Management of Ship Design at the Ship Engineering Center," 12 Annual Symposium

The description in the "objective column" is the assured definition of ship design that should meet specific requirements and the estimated cost that can be refined at that phase.

		PRODUCTS
C O N C E P T U A L P H A S E	FEASIBILITY STUDIES	a- "concept selection" b- Class E or F cost estimate c- definition of payload d- synthesis model weight (1 digit level) space allocations (developed by hand if synthesis model not available) e- general arrangements drawings (if a "hand study") f- complement (officers, CPOs and enlisted) g- type of machinery and number of propellers h- speed i- installed electric power j- general ship geometry including total ship volume and area estimates Above items are included in the Feasibility Study Report
	CONCEPTUAL DESIGN	a- Class D cost estimate b- draft TLR c- Conceptual Baseline (CBL) Package <ol style="list-style-type: none"> 1. design rationale 2. general arrangement drawings 3. weight estimate at 3 digit level 4. body plan 5. transverse and damage stability seakeeping analysis 6. speed/power curve 7. structural midship section (optimal) 8. tentative combat system block diagram 9. preliminary weapons equipment list 10. manning list 11. preliminary master equipment list 12. propulsion/propeller analysis 13. preliminary machinery arrangement 14. power analysis and tentative generator selection 15. auxiliary machinery analysis 16. preliminary electronics space and topside arrangements

	PRODUCTS
PRELIMINARY DESIGN	<ul style="list-style-type: none"> a- Class C cost estimate b- TLS c- Planning Documents <ul style="list-style-type: none"> 1. ILS Plan 2. Combat System Management Plan 3. Hand Based Test Site Management Plan (if required) 4. T&E Master Plan d- FBL Package <ul style="list-style-type: none"> 1. Master Equipment List (MEL) 2. Preliminary Ship Manning Document 3. Noise Evaluation and Ship Protection Analysis 4. RMA Analysis 5. Structural Analysis and Drugs 6. General Arrangements 7. Space Arrangements 8. Access Studies 9. Habitability Studies 10. Weight Estimate 11. Stability Analysis 12. Resistance/Seakeeping/Maneuvering Analysis & Model Tests 13. Propulsion System Analysis 14. Electrical System Analysis 15. Machinery & Auxiliary Arrangements 16. Preliminary descriptive system analysis 17. HVAC Requirements & Diagrammatics 18. Deck & Weapons Systems Analyses & Drawings 19. Ship Control Analysis 20. Combat Data Document 21. Combat System Block Diagrams 22. Combat System Description 23. Combat System Space Arrangements 24. IC, Navigation, Radar, IFF & Sonar Analysis 25. Antenna Arrangements & topside Design Performance Assessment 26. External Communications & Command and Control Description
CONTRACT DESIGN	<ul style="list-style-type: none"> a- Class B and/or Class A cost estimate b- Ship Specification c- Planning Documents for Detail Design & Construction Phase (further developments of plans listed under Preliminary Design Products) d- ABL Package (Contract, Contract Guidance and Study Drawings with Selected studies and guidance documents) - Consists generally of updates and further developments of preliminary design products with the addition of 30-40 drawings and system diagrams and several studies which provide more detailed definition of subsystems e- "Backups" analytical studies - not provided to shipbuilder f- GFE procurement specifications g- GFI requirements definition h- Contract Data Requirements Package i- Preliminary Operational Stations Booklet j- Mock-ups

Spauling, op. cit.

The description in the "products column" is the result of a designing team's effort in producing the appropriate technical documents or drawings which are sufficient to verify

the quantity and quality of the design and the accuracy of the estimated cost of that phase.

		PROCESS
C O N C E P T U A L P H A S E	FEASIBILITY STUDIES	a- small group effort (3-4) people b- synthesis model (50-300 ships) or "hand" (2-30 ships) analysis (5% accuracy on ship weights) c- cost program operates on synthesis on hand study outputs d- general arrangements drawings developed with hand studies e- performance interns of speed, endurance, major payload items and special features (side protections, etc.) f- relative accuracy and consistency vs. "absolute" nature of results is stressed g- for non state-of-the-art designs, basic design methodology must be developed prior to that of Feasibility Studies
	CONCEPTUAL DESIGN	a- "team effort" (15-25 people) b- continual interaction with TLR development (military effectiveness studies in parallel) c- ship sized on an "absolute" basis vs. "relative" basis in Feasibility Studies d- major subsystems trade-offs e- development of credible space/weight budget f- emphasis on resolution of major technical risks
PRELIMINARY DESIGN		a- Major effort (60 men (NAVSEC only) S2-3 m) b- Design-to-cost trade-off analysis "design review" and selection <ol style="list-style-type: none"> Subsystems <ul style="list-style-type: none"> Hull form General Arrangements Electric Power Propulsion System Auxiliary Systems HVAC Deck & Weapons Handling & Replenishment Systems Ship Control Structures Ship Manning Weapons & Sensors Antennas & Topside Design Performance Ship Entity Characteristics <ul style="list-style-type: none"> Noise and Vibration Ship Protection ILS/RMA c- Intensive ship system level integration/optimization analysis d- Focus on TLS development e- Combat systems integration with ship system f- "Design freeze" at completion of subsystem and ship entity characteristics selection

	PROCESS
CONTRACT DESIGN	a- major effort (120 men - NAVSEC - S7 m+) b- emphasis on: <ol style="list-style-type: none"> 1. preparation of ship specifications 2. CDRL package preparation 3. contractibility and producibility of ABL package 4. GFE/GFI definition c- detailed subsystem/equipment definition d- final system performance validation by model tests e- detailed space layouts f- mock-up evaluation of such spaces as bridge and office complex g- intensive final package review and adjudication effort h- formal configuration control

Spauling, op. cit.

The description in the "process column" is for general guidance only to show average manpower needed for each design phase, special attention to be given to the floor area, volume and weight of the design. Furthermore, it shows the importance of individual interface and integration when dealing with design-to-cost and trade-of-analysis.

D. DESIGN CAPABILITY, THE KEY FACTOR IN SHIP ACQUISITION

PROCESS

Referring to the development of the United States Foreign Military Sales Program and its principle objectives, it is quite clear that arms transfer can also be a form of transfer of technology that will enable the receiving country to build at home. For the benefit of both countries, requests for technology transfer should be granted as long as the receiving country can assure the commitment of a progressively large share of defense budget funds without undue burden to their economies and the project is to the interest of the U.S. and

global security. Furthermore, according to Section 38 of AECA as amended, there is no dollar limit on commercial sales.

Since the R.O.C. government in Taiwan is facing certain difficulties in the international community and is unable to purchase naval vessels elsewhere, technical assistance from the United States is of prime importance for an indigenous naval ship building program. Since Taiwan's military forces have been girded to the American hardware system for almost half the century, it is rather natural that "Buy American" is the first thought in the R.O.C. Unless America is reluctant to supply something, "Buy American" is the R.O.C.'s military purchasing policy to get the most rational use of American industrial, economic and technological resources, to achieve the greatest attainable military capability at the most reasonable cost, greater standardization and inter-operability of the weapon systems. Because it would be too costly to change the military system, needed equipment such as main engines, various auxiliaries and spare parts, etc., must be purchased from the United States. The cost reimbursed can in turn counter-balance some of the trade deficit between the United States and R.O.C. Hence, it can be concluded that the effective implementation of this policy would benefit both countries economically and militarily.

The ship building process as a whole consists of design and construction. Ship design is deemed the upper stream job while construction lies in the down stream. In other words, design

is the root of the shipbuilding industry. Without a design capability shipbuilding is only a rootless industry. By this token, the R.O.C. Navy should begin to cultivate with great effort a naval ship design capability.

Referring to the on-going R.O.C. Navy PFG Construction program, the design was purchased through TDP of U.S.F.M.S. The construction in CSBC is technically cooperated with BIW. Purchasing an existing design is a kind of technology transfer, but it leaves one wondering whether it includes the "know-how" or not. As has been mentioned before, the design is a factor of paramount importance in the ship acquisition process. Usually, the ship design was done by the "in-house" organization of the U.S. Navy before Contract. Only when there are many projects and the ship design workload is beyond the capacity of the "in-house" design organization, does the Preliminary and Contract Design or Contract Design alone transfer to the private design company. Upon award of the shipbuilding contract the shipbuilder has to carry on the detail design for the construction.

Ship design is labor extensive in engineering efforts. An average Preliminary Design now uses 30,000 man-days and an Average Contract Design uses 50,000 man-days of engineering [Ref. 12: p. 105]. As to the design duration of various phases, Dr. Johnson refers to "Ship Design Project Histories" of NAVSEC Document 6110 (Naval Ship Engineering Center, NAVSEC, which was created in 1966 and was merged in 1979 into

Naval Sea Systems Command, NAVSEA) and stated in his paper for the FFG-7 class. The author would like to summarize the important figures regarding the FFG design in the paper and the document in Table III for reference.

The historical information should be a useful reference document for all those involved in small warship procurement process. They have obviously spent a great deal of time in putting together a considerable amount of information. This information shall be of invaluable resource for comparison and analysis, planning, programming, budgeting and controlling of new ship designs for N.S.D.C. and the newly established Navy Ship Acquisition Management Office (NASANO) in R.O.C. Navy.

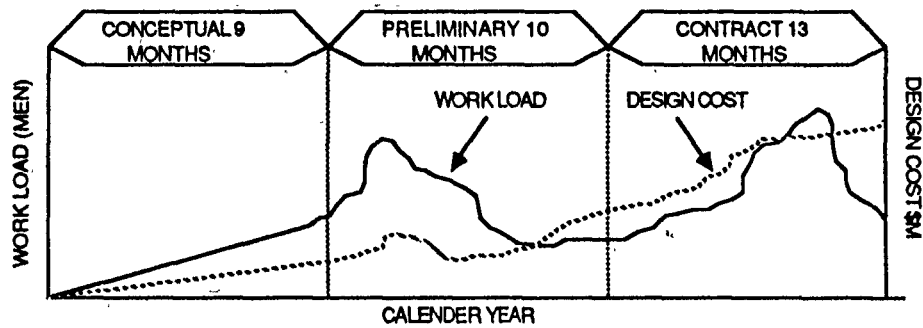
Generally speaking, vessels designed and built by the United States are too large and expensive to be suitable for other navies. FFG-7 Oliver Hazzard Perry Class frigate are at the bottom end of the U.S. Navy's inventory of warships in both size and cost. Though is it suitable for the R.O.C. Navy, the original weapon systems may not be available for whatever the reasons. Therefore, changes have to be made to suit whichever systems they can get. Hence, modifications or alterations of the original purchased design become an urgent problem.

For the above case, either ROC Navy or CSBC may have to arrange a special agreement asking the original design organization for assistance to solve this particular design problem. This difficulty clearly shows that transferring only

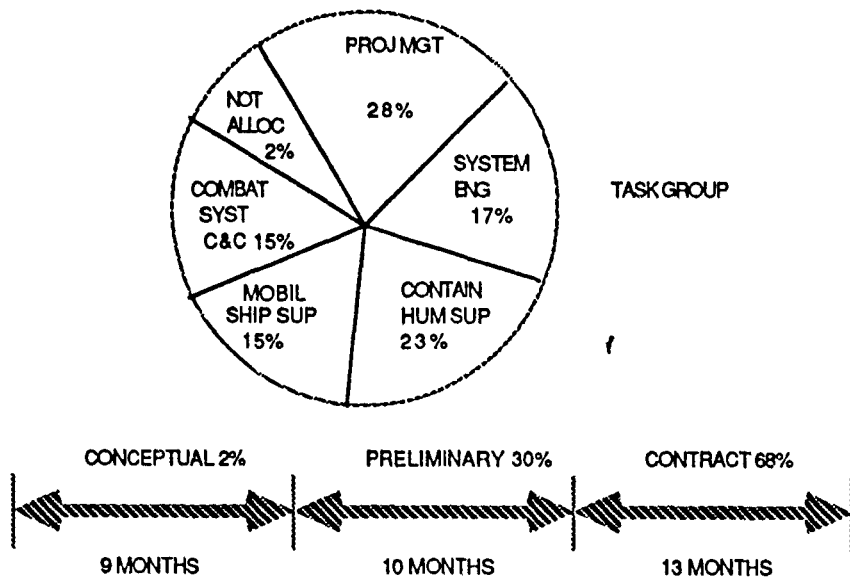
TABLE V. PATROL FREIGHT (PF) SHIP DESIGN SUMMARIES

A. Special Factors About This Project:			
1. FFG-7 is a high priority program. The Navy urgently wants to replace the World War II hulls which had to be retired.			
2. OPNAV directed that the ship be limited to 3,400 tons and \$45 million ship cost, which caused the FFG-7 to be the first "Design-to-Cost" ship.			
3. About 20-30 person Technical and Management Project Team was assembled to run the program in NAVSEC for a tight schedule (23 months to complete Preliminary and Contract Design).			
B. Various Statistics in Three Design Phases			
Design Phase	Feasibility/ Concept	Preliminary Design	Contract Design
Design Cost (Jan. 1975)	\$193,000	\$2,982,400	\$6,759,100
Design Duration	9 months (can be completed in a matter of 2-3 months with 8- 16 man-days per day)	10 months	13 months
Design Man-Days	not available	25,000	51,000
Documents			
Studies/ Reports	1	68	196
Drawings	6	47	142
Specifications	1 (TLR)	1 (TLR)	1 (ship specifi- cation)
Model Tests	0	8	28
Design Briefings	3	24	30
Planning/ Management	1	11	52
Design Notebooks	30	79	66
TOTAL	42	238	515

C. PATROL FRIGATE ENTIRE DESIGN COST STRUCTURE DIAGRAM



GENERAL FEATURE OF CUMULATIVE COST AND WORK LOAD OF DESIGNING PRITROL FRIGATE



PARTROL FRIGATE DESIGN COST BY TASK GROUP & PHASE

the construction technology is not enough to satisfy the need. Measures should be taken for transferring the design technology not only for the on-going construction but also for later follow ships and future projects. Now is the appropriate chance for cultivation the naval ship design capability.

RECOMMENDATIONS AND CONCLUSIONS

A. RECOMMENDATIONS

1. Arrange the original PFG design organization to send an engineering team to Taiwan to perform the drawing modification. NSDC should select their designers to work with the team. The best way to transfer the technology is through people and to work together on the job.
2. Recruit more personnel with technical backgrounds to join the NSDC functional organizations and arrange necessary training to enhance the design capacity. NSDC should have suitable designers to handle one ship project of PFG size.
3. Taiwan should have a suitable hydrodynamic laboratory for model tests and R&D.
4. NSDC should arrange technical cooperation with a reputable American private design company to improve the design capability.
5. Set up a computer center and technical library in NSDC to form a technical information center.

R.O.C. should fully utilize the techniques transfer to accumulate experience, cultivate man power, set up systems (management/logistics/operations) and further upgrade our own warship design capabilities and shipbuilding techniques.

B. CONCLUSIONS

The R.O.C. on Taiwan, however, is still facing a military threat from Communist China. The United States has adopted a two-track China policy since 1978, maintaining trade and cultural ties with the people on Taiwan while improving its

relations with the Communist China. But the United States has made commitments to the R.O.C. in accordance with the Taiwan Relation Act, and those commitments are closely linked to the vital interests in that area and the interests of the United States.

At present, the U.S. policy on arms sales to the R.O.C. remains ambiguous. In many cases, Washington has denied the R.O.C.'s request for sophisticated fighters and other necessary weapons for defense purposes. Given the U.S. policy of keeping military balance in the Taiwan Strait, the U.S. should adequately provide the R.O.C. with defensive weapons to maintain the stability and prosperity of the Republic of China and to safeguard the peace and security of the Asian-Pacific region.

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